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INFLUENCES ON FERTILITY AND INFANT MORTALITY IN DEVELOPING COUNTRIES:  
THE CASE OF MALAYSIA

Julie DaVanzo and William P. Butz

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## **A Rand Note**

**prepared for the**

AGENCY FOR INTERNATIONAL DEVELOPMENT

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**Rand**  
SANTA MONICA, CA. 90406

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PREFACE

This Rand Note documents a briefing on fertility and infant mortality in developing countries, presented by Julie DaVanzo to the Rand Board of Trustees at its semiannual meeting in Santa Monica on November 9 and 10, 1978. The briefing was the last in a series of three on the work of Rand's Labor and population Studies Program. The first two briefings comprised James P. Smith on "An Overview of the Labor and Population Program" and William P. Butz on "Countercyclical U.S. Fertility and Its Implications" (the latter summarized in W. P. Butz and Michael P. Ward, Rand Paper P-6263, November 1978). The work was supported by a grant from the U.S. Agency for International Development.

This Note is a non-technical review of research that will be reported in detail in William P. Butz and Julie DaVanzo, Contraception, Breastfeeding, and Birthspacing in Malaysia, R-2352-AID, forthcoming, 1979. Readers desiring more detailed information about the overall project should consult William P. Butz and Julie DaVanzo, The Malaysian Family Life Survey: Summary Report, R-2351-AID, March 1978.



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INFLUENCES ON FERTILITY AND INFANT MORTALITY IN  
DEVELOPING COUNTRIES: THE CASE OF MALAYSIA

THE DEMOGRAPHIC AND POLICY SETTING

In economically advanced countries like the United States, the fertility rate is generally low and approaching levels consistent with zero population growth. However, in developing countries fertility rates are much higher.

Figure 1 shows that the total fertility rate in Malaysia is more than twice as large as in the United States. At 1970-73 fertility rates, women in Malaysia would have an average of 4.4 children by the time they complete childbearing. The corresponding number for the United States is just over two children per woman.

The dramatic differences in fertility illustrated here are reflected in even larger differences in annual rates of population growth. Whereas the United States population is growing at a rate of less than one percent per year and would require nearly a century to double, Malaysia's rate of population growth is 2.8 percent. At this rate, the Malaysian population will double every 25 years.

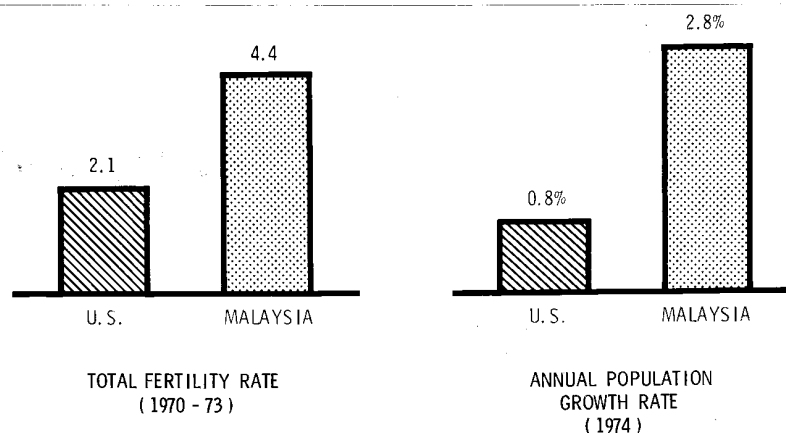


Fig. 1 — Fertility and population growth:  
U.S. and Malaysia

Malaysia, like many developing countries, is concerned about its high rate of population growth. Policymakers in many developing countries feel that high population growth rates are aggravating problems of unemployment, poverty and hunger, and hindering their prospects for further economic development. Large portions of their governments' budgets are being used to provide public services to accommodate the growing population. They feel that increases in population are diluting hard-won economic and social gains.

The major policy response to high rates of population growth in developing countries has been the wide-scale institution and support of national family planning programs, whose primary function is distributing contraceptives. The first developing country to adopt a family planning policy was India, in 1952. By 1960 seven developing countries has family planning policies. However, by 1976 94 percent of the developing world's population lived in countries with governments supporting family planning. Many foundations and United States government agencies view support of the distribution of contraceptives through family planning programs as the most cost-effective type of foreign aid or technical assistance they can give.

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For example, World Bank loans for population rose from two million dollars in 1970 to forty million dollars by 1975. The Rockefeller and Ford Foundations together spent between fifteen and thirty million dollars per year on population assistance between 1970 and 1977. And the United States government through the Agency for International Development has provided more than 530 million dollars over the last decade to distribute contraceptives through family planning programs in developing countries.

Nevertheless these programs have not always been successful. After several years of initial success, family planning program acceptance rates often drop off. Fertility rates have fallen in many places since the programs began, but the extent to which the programs are responsible is frequently unclear, since fertility rates were usually declining before the programs began.

An implicit "model" underlies this family planning policy response to high rates of population growth: supply the contraceptives and couples will put them to use; this use will lower birth rates and, in so doing, promote economic development. Such a simple view neglects important, sometimes critical, factors.

Our study investigates the influence of some of these important factors on Malaysian women's fertility. In the next section, we sketch the basic biomedical and behavioral relationships hypothesized in our model. We then describe the Malaysian Family Life Survey data that we used to test these hypotheses, and we summarize the findings of our initial econometric analyses. Though these findings are preliminary, they have important potential implications for policy, which we outline in the last section.

#### A CONCEPTUAL MODEL

Figure 2 shows the hypothesized relationships between population growth and the major biomedical and behavioral factors that influence it.

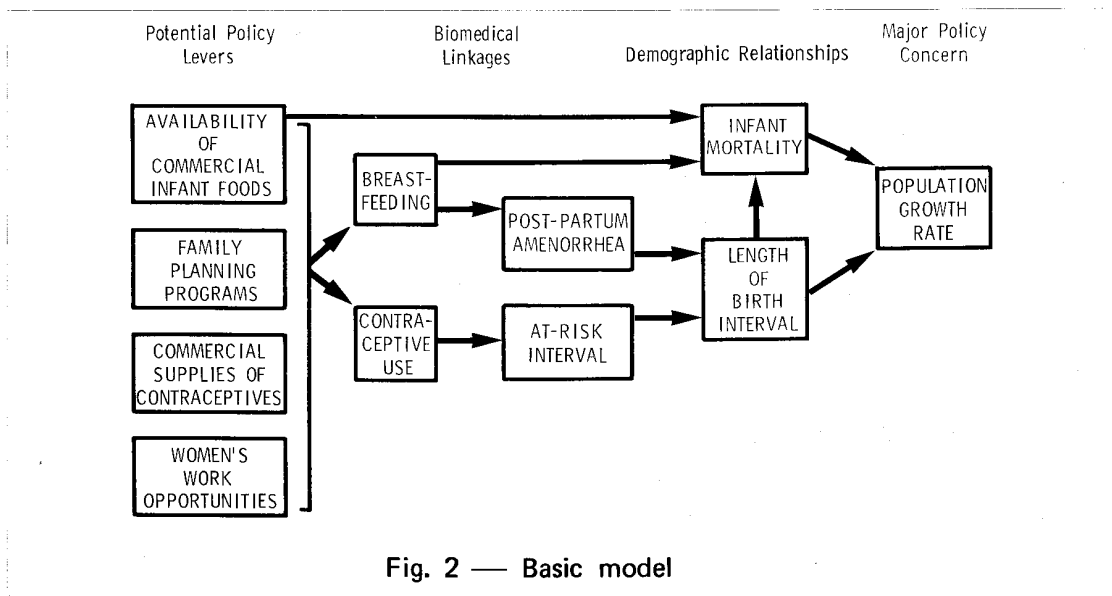


Fig. 2 — Basic model

Our ultimate concern is the rate of population growth (shown at the right of the figure), which is determined by both mortality and fertility rates. Our research thus far has focused on infant mortality and the pace of fertility--that is, the spacing of births. The pace of childbearing affects the rate of population growth because, for a given completed family size, closer birthspacing will result in higher rates of population growth. For example, if all women have three children but those in one area give birth at ages 20, 22, and 24, while those in another area give birth at ages 20, 30 and 40, the former area's population will grow more rapidly than the latter's.

The unit for measuring birthspacing is the birth interval--the time that elapses between one birth and the next. The birth interval consists of two main parts. The first is the length of post-partum amenorrhea, the infertile period following a birth. The second is the subsequent period during which the woman is able to conceive--often called the at-risk or menstruating interval. It is useful to divide the birth interval into these two parts because different factors affect the length of each.

Clinical studies have shown that breastfeeding is an important determinant of the length of post-partum amenorrhea, as pictured in Fig. 2. Women who breastfeed longer generally have longer post-partum amenorrhea. This relationship is important because of the dramatic declines in breastfeeding that have occurred in most countries. Whereas 50 years ago nearly all infants were breastfed, today the practice is declining in virtually all less developed countries.\* As fewer women breastfeed, and for shorter periods of time, lengths of post-partum amenorrhea have shown corresponding declines. In Malaysia,

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\* It is interesting to note that, despite the dramatic declines in breastfeeding that have occurred in the last 50 years, a recent study estimated that in developing countries breastfeeding currently provides a one-third longer period of protection against conception than do family planning program contraceptives.

for example, our data indicate that the average length of post-partum amenorrhea of women in the most fertile ages (15-24 years) is less than half what it was in the 1940s. The average young mother in Malaysia today becomes fertile again less than five months after giving birth, whereas in the 1940s young Malaysian women averaged over ten months post-partum amenorrhea.

Breastfeeding affects not only the length of post-partum amenorrhea, but also the infant's mortality probability (and, more broadly, its health). Mother's milk is known to be the most nutritious food an infant can have. In addition, it is more sanitary than other types of foods, and it contains antibodies that help protect a baby against infection for several months after birth.

Thus, nursing provides more than just food. For the newborn child, it reduces the chance of mortality. For the mother, it reduces the likelihood of becoming pregnant again soon.

An infant's chance of mortality is also influenced by the length of the birth interval preceding its birth, as Fig. 2 suggests. Biomedical studies have shown that a child born at the close of a short birth interval has a lower chance of survival than one born after a longer interval.

Following the period of post-partum amenorrhea, conception is again possible in the at-risk interval. During this fertile period, contraceptive methods can delay or prevent the next conception.

Most of these biomedical relationships shown in Fig. 2 have been well established in numerous clinical studies. Our research is not unique in considering them. What is unique to our study is *simultaneous* consideration of the behavioral mechanisms that trigger these biomedical relationships. That is, we consider what factors encourage or discourage breastfeeding and contraceptive use. By doing so, we are able to show not only how changes in breastfeeding and contraceptive use might affect fertility and mortality, and hence population growth, but also how public policy might, intentionally or inadvertently, influence women's breastfeeding and contraceptive use. While some policymakers are aware of the biomedical relationships shown here, they (and social

scientists in general) have less systematic information about the underlying social and economic forces that influence families' decisions regarding desired numbers and spacing of children, contraceptive use, breastfeeding, and children's health. *Knowledge of how these biomedical and behavioral factors interact is almost nonexistent.*

We hypothesize that women choose to breastfeed and practice contraception not because they value these activities in and of themselves but because these activities produce outcomes they may (or may not) desire--*child health and longer birth spacing*. Breastfeeding and other infant foods are alternative means of feeding babies. Likewise, breastfeeding and use of other contraceptives are alternative means of spacing births; a couple can choose among various combinations of length and intensity of breastfeeding and length and type of contraceptive use if they wish to postpone a birth.

Breastfeeding and contraceptive use are not costless activities. Breastfeeding requires mothers' time and presence, as well as increased calorie intake. If women have attractive work opportunities outside their homes, the opportunity cost of their time spent breastfeeding (i.e., the value of their time in alternative uses) can be high. However, other forms of contraception might be relatively expensive to low-income families, and even contraceptives that are cheap in money terms may be unpleasant to use and hence have substantial "psychic" costs.

In our behavioral model, women decide whether and how long to breastfeed according to its perceived benefits and costs. Similarly, women choose whether to use other contraceptives and, if so, what types and for how long according to the perceived costs and benefits of the contraceptives.

The left-hand side of Fig. 2 shows four characteristics of communities and public programs that might affect the perceived costs and benefits of breastfeeding, contraceptive use, and child survival. We hypothesize that these policy-manipulable variables affect the policy outcomes of interest on the right-hand side of the figure through the behavioral and biomedical variables shown in the middle of the figure.



We are using this framework to answer a set of specific research and policy questions:

- o Why has breastfeeding declined? For example, what has been the role of increased availability of commercial infant foods? Of improved work opportunities for women? Of increased availability of contraceptives?
- o To what extent has the breastfeeding decline shortened birth intervals and increased population growth?
- o How has the breastfeeding decline affected infant mortality rates?
- o What influences the use of modern contraceptives? For example, does the proximity of a public family planning clinic or the availability of contraceptives in nearby stores encourage contraceptive use?
- o Finally, how might public policy influence contraceptive use, breastfeeding, birthspacing and infant mortality, and hence affect population growth?

Thus far, our preliminary research has focused mainly on factors that affect the *supply* of surviving children--contraceptive use, breastfeeding, and infant mortality--since these have been the major foci of interest among policymakers. But we feel that it is also important to consider the *demand* side--why parents want a certain number of children. Fertility rates may be higher in developing countries than in developed ones because children in developing countries are economic assets; they often help on family farms or in family businesses from an early age. Children also provide other kinds of economic security. Many parents in developing countries rely on their offspring to support them when they are old because they do not have institutionalized social security or pension systems. By contrast, most parents in the United States view their children as considerable economic liabilities. We will devote considerable

attention in our subsequent research to factors that affect parents' demand for children.

#### THE MALAYSIAN FAMILY LIFE SURVEY

As we developed our conceptual framework, it became apparent that no existing data had the range of information on couples and their communities that is required for estimating the model. Therefore, we decided to collect new data. We designed questionnaires and worked together with local collaborators in both Guatemala and Malaysia to adapt these questionnaires to the local settings.

In the Malaysian Family Life Survey, extensive current and retrospective data were collected on a national probability sample of more than 1200 families in Peninsular Malaysia. The data were collected by an experienced Malaysian market research firm, Survey Research Malaysia, following our extensive collaboration with officials and researchers in the Government of Malaysia. One unique feature of this (and the Guatemalan) survey is the current and retrospective information on both biomedical variables (e.g., lengths of post-partum amenorrhea) and economic and demographic variables (e.g., mother's wages and birth intervals) so that we could estimate the behavioral, biomedical, and demographic linkages in our model. We also collected detailed information on community-level characteristics and programs, including those policy-manipulable variables shown in the left-hand column of Fig. 2. Our surveys are nearly unique in collecting detailed information on socioeconomic, biomedical, community, and public program variables simultaneously.

We are using these Malaysian data to estimate a statistical model for a sample of more than 4000 birth intervals. Some preliminary results are now available, which we summarize in the next section. As the on-going research extends, and perhaps modifies, these results, we will report the implications in subsequent papers.

## PRELIMINARY FINDINGS

It is convenient to discuss our preliminary econometric findings under three main headings--breastfeeding, contraceptive use, and infant mortality.

### Behavioral Determinants and Biomedical Consequences of Breastfeeding

Our initial empirical research strongly indicates that breastfeeding decreases as the availability of *commercial* substitutes for its two functions increases--in other words, as infant foods and supplies of modern contraceptives become available. In Malaysian locales where more commercial infant foods are available, women breastfeed less, on average. Where contraceptives are available in nearby stores, women also seem to dispense with breastfeeding (which is, after all, a very time-consuming activity) and replace its contraceptive function with more effective and perhaps less costly modern contraceptives.\* Interestingly, however, proximity to family planning clinics appears not to discourage breastfeeding in this sample, but rather to encourage it somewhat. It may be that family planning clinic personnel in Malaysia actively promote breastfeeding, though we have not investigated this possibility.

Factors affecting the opportunity cost of women's time--their work opportunities and employment histories--also affect the likelihood and length of breastfeeding in our sample. Women who had been employed in the two years prior to a birth, and thus presumably had higher opportunity costs for time spent breastfeeding, are less likely to breastfeed. If they do, they breastfeed an average of 4-1/3 months less than women with no recent work experience.

Compatibility of jobs with child care and with breastfeeding also influences breastfeeding. We find that of Malaysian women who work, those with agricultural jobs, likely to be closer to home, are more likely to nurse their children and to do so longer. It is certainly easier for a woman to breastfeed if she has her child with her while she works on a family farm than if she works in a factory an hour's bus ride from her home.

\* We have not yet completely investigated the possibility that the supplies of contraceptives and baby foods may be larger in some communities precisely *because* there is a market for them there, that is, because many couples there already demand these services.

Despite the fact that our data are retrospective and refer to birth intervals as many as 25 years before the time of the survey, our assessment of breastfeeding's effect on the length of post-partum amenorrhea is very similar to the effect found in clinical studies. And like clinical studies, our study finds full breastfeeding (when no other food or beverage is given to the child) to be more effective in delaying the return of post-partum ovulation than is partial (supplemented) breastfeeding.

We also find, as have biomedical studies, that length of breastfeeding is positively related to the probability that a child will survive its first year. In our sample, full breastfeeding is somewhat more effective than partial breastfeeding in promoting child survival.

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#### Behavioral Determinants and Demographic Consequences of Contraceptive Use

We find that contraceptive usage rates are higher where more commercial infant foods are available in nearby stores. We noted earlier our empirical finding that women breastfeed less as supplies of commercial infant foods increase. These women apparently compensate for this loss in contraceptive protection from breastfeeding by using other contraceptives, mainly modern ones.

Increased availability of commercial contraceptives also tends to increase the probability that women will use contraceptives. However, in our preliminary results, women living close to family planning clinics appear no more likely to use contraceptives than women living farther away.

Improved job opportunities for women affect the opportunity cost of time they spend with children and may affect the number of children they want to have and how they want to space them. Our preliminary statistical results suggest important roles for these work-related variables in Malaysia. Malaysian women with jobs farther from home, and hence presumably less compatible with child care, are more likely to use modern contraceptives. Malaysian women with agricultural occupations, which should be more compatible with child care, are less likely to use contraceptives.

Not surprisingly, increased use of contraceptives has tended to increase the length of the second portion (the at-risk part) of the birth interval. Although modern contraceptives are the most effective, even some traditional methods, e.g., rhythm and folk methods, appear in our data to help delay pregnancy.

#### Determinants of Infant Mortality

Our preliminary analyses indicate that increased availability of commercial infant foods affects infant mortality in two ways. The direct effect is to reduce infant mortality: where more commercial infant foods are available, infant mortality rates are lower in our sample, other things being equal. Hence, holding constant the length of breastfeeding, commercial infant foods are apparently more nutritious than what would have been given to babies otherwise (e.g., rice porridge water). However, the increased availability of commercial infant foods also has an indirect effect on infant mortality through its effects on breastfeeding. We stated above that high availability of infant foods is associated with low breastfeeding in this sample and that low breastfeeding increases the risk of infant mortality.

Our estimates of these direct and indirect effects of commercial infant foods are practically identical in absolute magnitude and hence offset one another. Thus, we estimate that the net effect on infant mortality of increased availability of commercial infant foods is negligible, on average. The net effect in particular situations is of great practical interest and is on our current research agenda.

Another possible influence on infant mortality is the length of the birth interval preceding a child's birth. Our analyses show, as have clinical studies, that a baby born at the close of a short birth interval has a significantly lower chance of surviving its first year than one born after a longer interval. This relationship

may be partly behavioral if parents are less able (or want less) to care for a child who comes very soon after the preceding one. Our data indicate that in Malaysia closed birth intervals have become shorter in recent years. Hence, this closer birth spacing has probably prevented infant mortality rates from falling as rapidly as they would have otherwise. Also, as noted above, closer birth spacing keeps population growth rates from falling as rapidly as they would otherwise.

#### POLICY IMPLICATIONS

Although our analysis is still in progress, several of these preliminary research results have important potential implications for policy. We will discuss three policies which have been implemented or considered in a number of developing countries and note how our results for Malaysia reveal some important, perhaps unanticipated, side effects that could result from these policies.

1. Policymakers in developing countries, public health spokespersons, and newspaper editors in Europe and the U.S. often attribute the decline in breastfeeding in less developed countries to the promotion of commercial infant foods. Many who are concerned about the fertility and mortality consequences of the breastfeeding decline in less developed countries are therefore campaigning to restrict the activities of commercial infant food companies. Our preliminary econometric results suggest that restrictions on the availability of commercial infant foods are unlikely, on average, to affect infant mortality in Malaysia (recall, the direct and indirect effects offset one another). However, by increasing the length of breastfeeding, such restrictions on marketing of baby foods would tend to reduce women's use of more effective modern contraceptives. There is virtually no other scientific evidence concerning these effects of commercial infant foods on fertility and infant mortality in any less developed country. Until there is, we suggest that general prohibitions on the commercial supply of baby food may have undesirable effects on use of modern contraceptives that could outweigh

whatever desirable effects may ensue for infant mortality. Scientific analyses of these effects in particular settings and for couples having particular characteristics are necessary, in our opinion, before general restrictions on commercial baby food distribution can be advocated responsibly.

2. Less developed countries often encourage female labor force participation in order to promote economic growth and reduce fertility. However, our preliminary results for Malaysia suggest that encouraging female labor force participation in jobs incompatible with child care might cause women to breastfeed less. If these women do not increase their use of modern contraceptives and nutritious infant foods to make up for reduced breastfeeding, serious consequences for both fertility and children's health could result.

3. As we noted at the beginning, the main policy response to high population growth rates in less developed countries has been large expenditures for distributing contraceptives through family planning programs. Although our preliminary analyses indicate that *commercial* availability of modern contraceptives in Malaysia tends to encourage their use, proximity to family planning clinics appears, *on average*, to have little effect. This is a puzzling finding which may be reversed in subsequent analysis for particular kinds of couples and communities. It is interesting, nevertheless, that our empirical results are weakest for the very relationship where the policy response has been strongest.

Moving beyond the Malaysian setting of this study, our preliminary analyses hint that two of the most prominent policy responses to high fertility and infant mortality--conventional family planning programs and restricting the activities of commercial infant food distributors--may not be the most effective policy choices in many situations. Furthermore, policies not designed to affect population growth directly, such as encouraging female labor force participation, may have important effects on fertility and infant mortality. All this underscores the need for a comprehensive approach--both in research and in policy--that examines both direct and indirect

effects and both socioeconomic and biomedical relationships. Such an approach should result in better estimates of the *total* effects of any particular policy option, and thus in more informed policy decisions.





